Center Innovation Fund: KSC CIF

Micro-scale Plasma Arc Gasification for Waste Treatment and Energy Production (MPG)

Completed Technology Project (2015 - 2016)

Project Introduction

As NASA continues to develop technology for spaceflight beyond low earth orbit, we must develop the right systems for sustaining human life on a long duration or planetary mission. Plasma arc gasification (PAG) is an energy efficient mechanism of waste management for power generation and synthetic gas (syngas) production.

Syngas can be chemically manipulated to create desired gases such as oxygen and methane on long duration missions from mission waste. Syngas can also be used directly to power small thruster engines for propulsion. PAG is a high temperature, high frequency and low volume gas emission system that dissociates organic compounds in a cleaner fashion when compared to current gasification and incineration processes utilized on Earth. PAG has only been used on large scale municipal waste systems and in this project we will demonstrate the feasibility of a micro-scale system to other waste proAs NASA continues to develop technology for spaceflight beyond low earth orbit, we must develop the right systems for sustaining human life on a long duration or planetary mission. Plasma arc gasification (PAG) is an energy efficient mechanism of waste management for power generation and synthetic gas (syngas) production. Syngas can be chemically manipulated to create desired gases such as oxygen and methane on long duration missions from mission waste. Syngas can also be used directly to power small thruster engines for propulsion. PAG is a high temperature, high frequency and low volume gas emission system that dissociates organic compounds in a cleaner fashion when compared to current gasification and incineration processes utilized on Earth. PAG has only been used on large scale municipal waste systems and in this project we will demonstrate the feasibility of a micro-scale system to other waste processing technologies to see if the power, mass and volume is comparable for volume reduction and energy production.

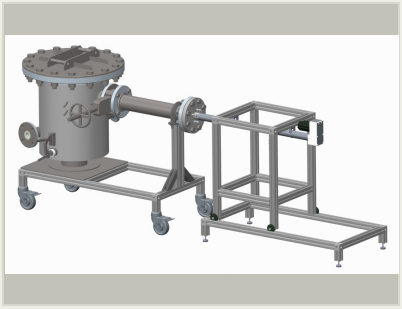
Anticipated Benefits

This technology would not only create a *dynamic* shift to waste processing on board space vehicles and space habitats for long duration missions. Also provides a technology for residential, commercial and confined populations to manage their waste and possibly generate energy. Such a technology could eventually create a closed loop sustainability path.

Major benefits:

•Higher efficiency in reducing logistical waste volume on board vehicle or habitat & potentially produce useful ECLSS gases (water and oxygen)

•Requires less feed gas commodities & system hardware than current waste processing technologies that are being investigated for long duration space missions



Concept of laboratory waste feed and reactor system that will be built and tested in the labs at KSC

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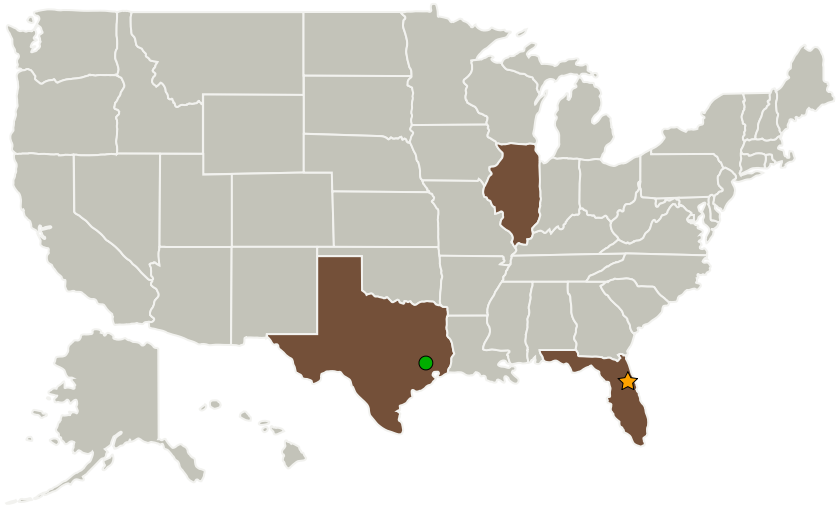
•Would provide the ability to process a vast array of wastes on a long duration mission (i.e. medical, hazardous & food packaging) with a cleaner product stream at higher efficiency

•Provide fuel for micro thrusters on deep space mission

•Less up mass for future missions with potential energy production

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Kennedy Space Center(KSC)	Lead Organization	NASA Center	Kennedy Space Center, Florida
●Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Co-Funding Partners	Type	Location
PEAT International	Industry	Northbrook, Illinois

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Kennedy Space Center (KSC)

Responsible Program:

Center Innovation Fund: KSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Barbara L Brown

Project Manager:

Nancy P Zeitlin

Principal Investigator:

Anne J Meier

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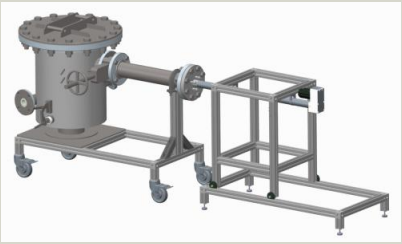
Florida	Illinois
Texas	

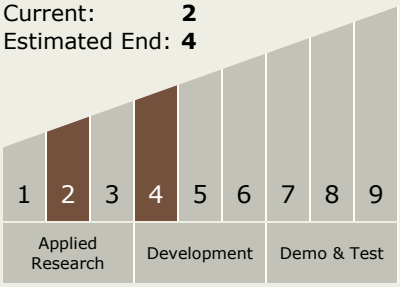
Images



MPG Reactor Concept
Concept of laboratory waste feed and reactor system that will be built and tested in the labs at KSC *(https://techport.nasa.gov/image/19215)*

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **4**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.1 Logistics Management